Ontario

ORDER NO. 90-228
NOVEMBER 1990
AGDEX 751

Factsheet

GABION BASKET DROP STRUCTURES ALONG WATERWAYS

91-03858/

(Revision of Factsheet "Gabion Basket Drop Structures Along Waterways", May 1985)

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USES

Gabion baskets are an effective and relatively inexpensive type of drop or check dam structure. Agricultural uses could include:

1. drops along waterways and at lane crossings to create shallower and less erodible slopes
2. drops at a waterway exit into drainage ditches

Other uses, although not as common for agriculture, could be as streambank protection and as retaining walls for protection against hillside erosion. Design parameters for agriculture limit their practical uses to between 0.3 and 1 m vertical drops, intermittent flows up to 1.5 m^3/s, and depth and width of spillway of 0.15-0.5 m and 0.6-2.4 m respectively. See Figure 1.

ADVANTAGES

1. Gabions can be purchased in various sizes to suit the height and width of drop required.
2. Economical, especially if field stone is available.
3. Less costly than rock chutes, especially if rock must be trucked in.
4. Easy to transport, assemble and install.
5. Channel gradient is reduced, encouraging soil deposition and vegetative growth.
6. Gabions are flexible, allowing settlement or frost movement without fracture.
7. Little maintenance is required and they can remain as permanent structures.

DISADVANTAGES

1. Gabion rock (75-125mm) can be difficult to obtain at some quarries.
2. Baskets are not widely available.
3. Basket wire can deteriorate after several years.
4. They are limited to intermittent flows and small drainage areas.

DESIGN

The number, location and height of drops will depend upon the:

1. design flow capacity and depth of flow desired over the drop (see Figure 2)
2. desired shape and slope of waterway between the drops to minimize erosion
3. amount of excavation required at the drops or along the waterway or both
4. cropping practices, to be compatible with field machinery
5. gabion drop sizes available

These design parameters should be determined by a consulting engineer or a qualified erosion control contractor.

INSTALLATION

After the number, size and location of drops have been determined, installation may proceed as follows.

Refer to Figure 1 as necessary.

1. Determine the volume (m^3) of gabion rock (75-125mm) required to fill all the baskets, and apron areas as required. The rock weighs approximately 1.8T/m^3, and should be trucked from pits as close as possible to the gabion locations.
2. The wire gabion basket is transported flat, is very light (approx. 15 kg each) and several can be carried at once in the back of a pickup truck.
3. Filter cloth should be used liberally under the baskets, extending up the sides at least 1 m beyond the baskets, and at least 2 m up the waterway to help prevent 'tracking' of water downward, in front of the baskets. Filter cloth allows water to drain through it and the baskets, but holds the soil behind and under the baskets. Joints should be overlapped at least 0.5 m.
4. The waterway should be staked with reference heights to ensure that the gabions are installed at the correct elevation.
5. The gabion structure must be installed perpendicular to the waterway flow.
6. The gabions are installed as 'steps' with the top basket across the waterway sitting on 2 or 3 gabions running parallel to the waterway. 125mm or larger rock beyond the exit apron gabions may be necessary to prevent undermining as the water exits from the drop. In most cases the total apron length will be 1-2 m.

7. The exit apron gabions need not be as wide as the entrance gabion to save on cost.
8. A 1 metre length of riprap (125mm rock or larger) 0.2 metres in depth is required above the entrance apron to protect the structure from upstream erosion.
9. Baskets should extend well into the bottom and sides of the channel to prevent washouts underneath or around the sides. 0.6 m (2') both sides is suggested.
10. The centre of the spillway should be as wide and flat as possible.
11. Bank walls can be made from heavy, treated lumber or rock to protect the entrance banks, and should extend 1 m minimum up the bank and up the waterway as far as the entrance apron.

COSTS

Cost can vary considerably but some typical costs are:

1. Baskets – $50-$75 each depending on size
2. Delivered Rock – $8.50/T($15/m^3)
3. Filter Cloth – $1.50 m^2

Labor, backhoe work, etc. is extra.

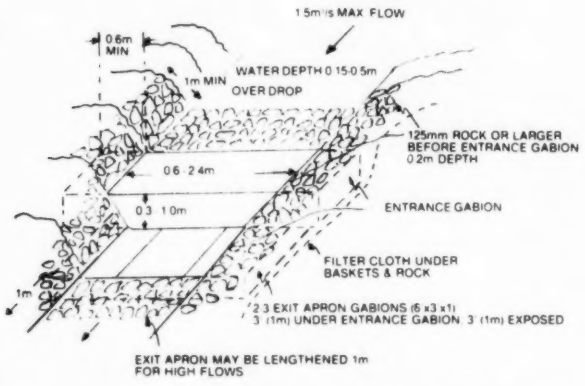
1.5m/s MAX FLOW
0.6m MIN
1m MIN
WATER DEPTH 0.15-0.5m OVER DROP
125mm ROCK OR LARGER BEFORE ENTRANCE GABION 0.2m DEPTH
0.6-2.4m
0.3-1.0m
ENTRANCE GABION
FILTER CLOTH UNDER BASKETS & ROCK
1m
2-3 EXIT APRON GABIONS (6 x 3 x 1) 3 (1m) UNDER ENTRANCE GABION 3 (1m) EXPOSED
EXIT APRON MAY BE LENGTHENED 1m FOR HIGH FLOWS

Figure 1. Gabion Basket Drop Design Parameters

	Width of Exposed Entrance Apron Gabion, Feet (m)	
Depth of Water Over Drop, Feet(m)	4' (1.2)	8' (2.4)
	Discharge, ft^3/s (m^3/s)	
0.5 (.15)	4.5 (0.13)	9.1 (0.26)
1.0 (0.3)	23 (0.65)	25 (0.71)
1.5 (0.5)	36 (1.0)	47 (1.33)

Figure 2. Approximate Flows Over the Drop (Adapted from Agriculture Canada Publication No. 1083, *Soil Erosion by Water*)

Example

It has been determined that about 0.75m^3/s of runoff water must be transported down a steep slope, and that one gabion basket dropping the water 0.5 m (1.5'), will be used to create a shallower sloped waterway both above and below the drop. Determine the size and approximate material cost of the gabion drop, assuming a 40 km drive for trucking rock.

Solution

From Figure 2, one practical alternative is to provide a 2.4 m (8') wide entrance apron, with an anticipated water depth of up to 0.3 m (1'). Gabions are generally available in standard imperial sizes for drops of 1, 1.5, 2, and 3 feet. Widths are available for 6, 9, and 12 feet, with a depth of 3 feet being standard. This provides 12 gabions of various sizes. In this case use a 12' x 3' x 1.5' gabion for the entrance gabion, sitting on 3 - 6' x 3' x 1' gabions running parallel to the waterway as in Figure 1.

With a depth of 0.5 m of water expected (including freeboard), 125 mm rock should be provided up the sides of the waterway about 1.5 m, both above and below the drop at a depth of 0.2 m. A 1.0 m length of entrance and exit apron of rock should be provided, also to a depth of 0.2 m.

In order to be under all the rock and baskets, the filter cloth must be at least 8 m long by 8 m wide.

EXAMPLE COST

Item	Amount	Approximate Cost
1. Gabion Baskets	1 - 12' x 3' x 1.5'	$ 75.00
	3 - 6' x 3' x 1'	150.00
2. Gabion Rock	3m^3	45.00
3. Channel Rock	3.25m^3	50.00
4. Filter Cloth	64m^2	96.00
		416.00

Labor, backhoe work, etc. could increase the above figure to $1000.

This small project would likely cost more for trucking because amounts are small. Also, most projects would include more than one drop so costs could decrease per drop.

ISSN 0225-7882